
Satellite Weather Information Service

June 5, 2001 Update

Agenda

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Overview

- ⌘ In-service evaluation of real time graphical weather information on flight deck
- ⌘ Provide updated graphical weather to pilots while enroute for strategic flight decisions
- ⌘ Trials to verify commercial benefits and technology feasibility
- ⌘ End solution is to provide wide area coverage for all classes of aircraft

Program Phases

- ⌘ Phase 1, Installed on single engine aircraft
- ⌘ Phase 2, Installed on two revenue service Air Transport Aircraft
 - ⌘ - Transoceanic routes
- ⌘ Phase 3 Plan, Install on 6-15 aircraft, all types
 - ⌘ Transcontinental routes
 - ⌘ CONUS operations

Program Phases

Phase 1. Verified that geostationary satellite can provide a sufficient signal level to aircraft using a fixed pattern antenna.

- Trials in South Africa in September, 1999
- Cessna 182 aircraft, Afristar satellite

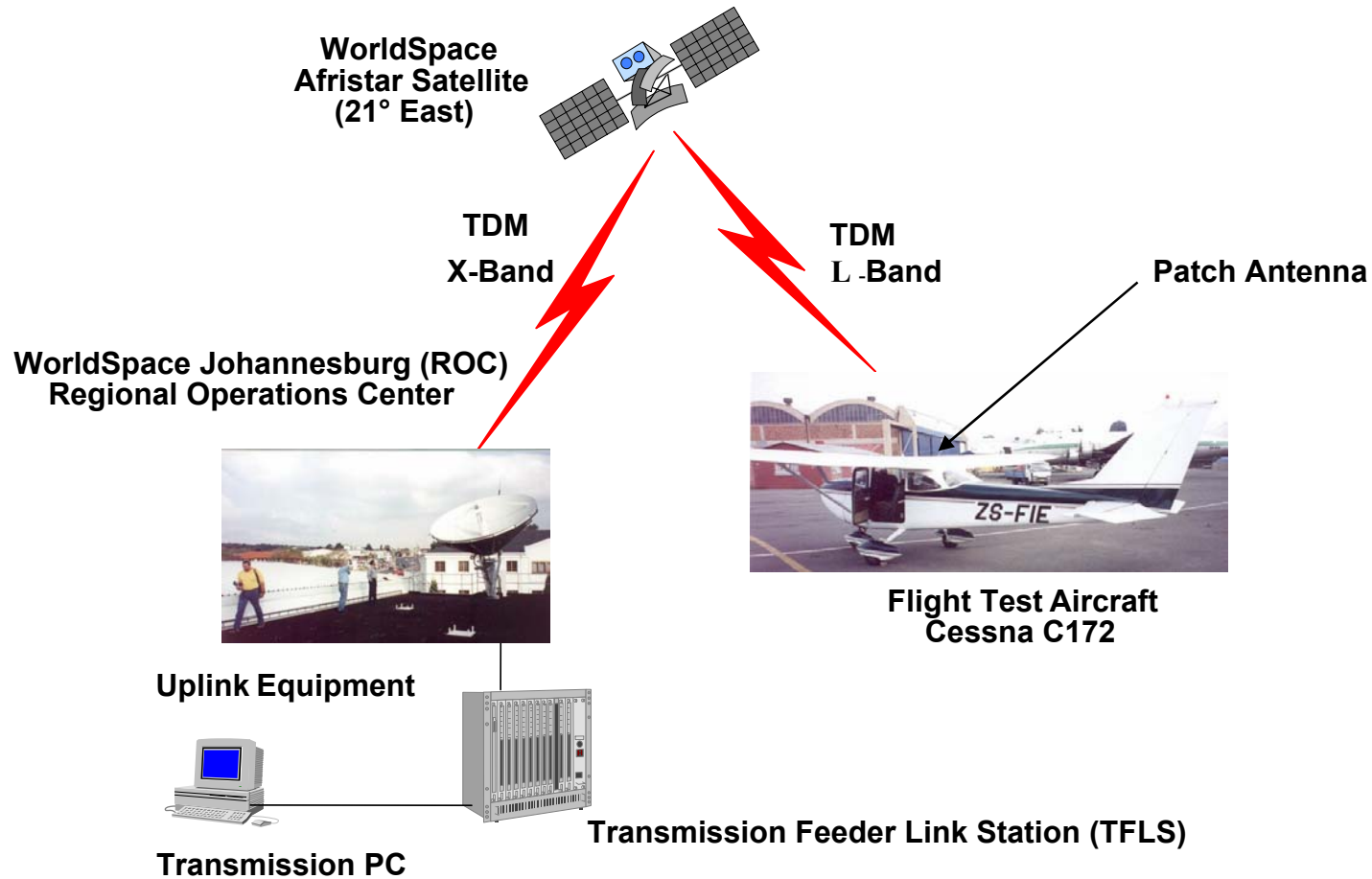
Phase 2. Validate the usefulness and pilots preferences of real time weather data

- Routes to the Pacific rim with American Airlines B777-200.
- Trials beginning June 2001, using Asiastar satellite

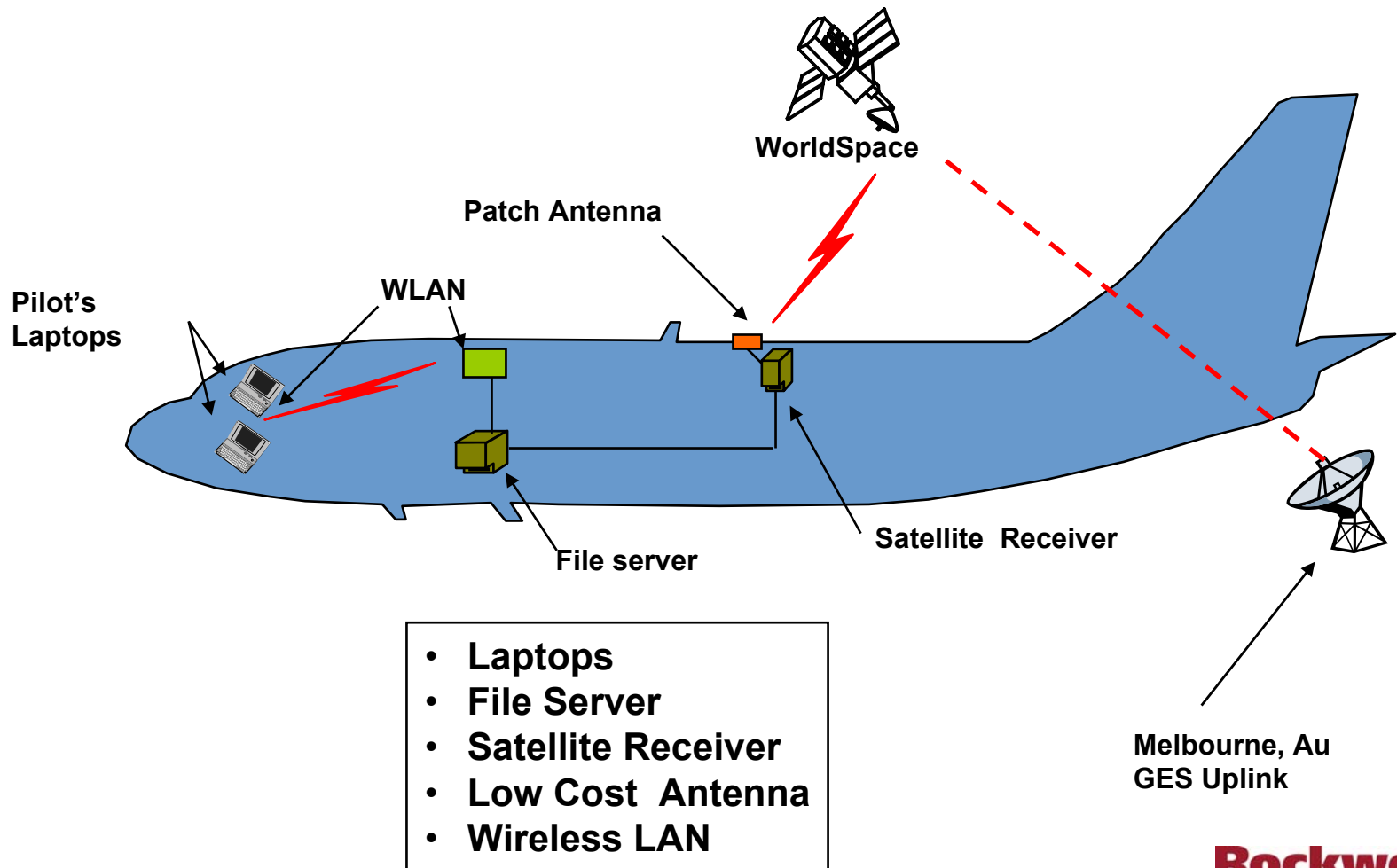
Phase 3. Planned extended trials to include Air Transport, Business, and General Aviation in USA and South America

- XM radio or other satellite (USA) , Early 2002.
- Ameristar satellite (S. America) , July 2002

Phase 1 System



Phase 2 System Configuration

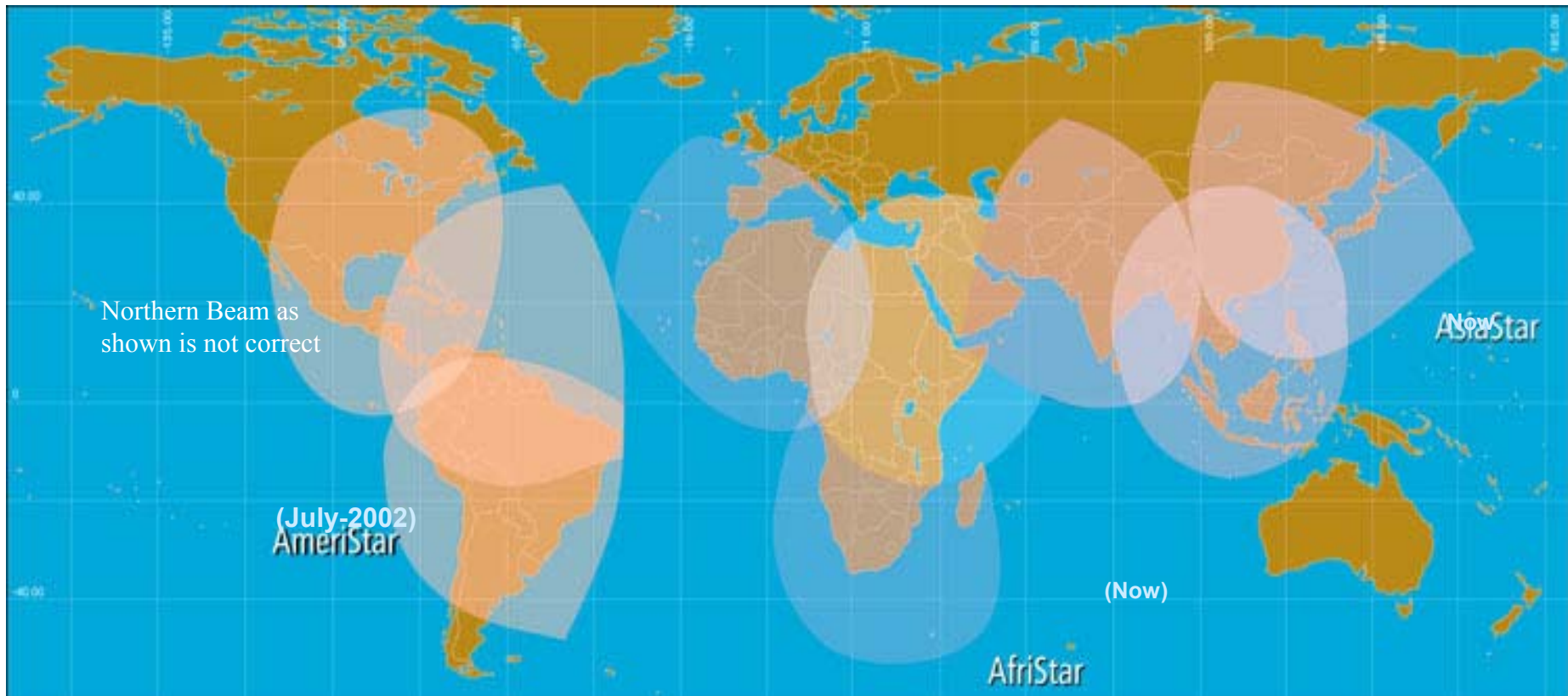


Geographical Coverage

WorldSpace satellites located at:

- ☒ Africa serves entire Africa and some Europe
- ☒ Asia, serves all of Pacific rim from Korea through Malaysia China and Eastern Russia, India, etc.
- ☒ Central America (2002), serves S. American and Caribbean

WorldSpace Coverage Areas



(NOTE: AmeriStar footprint shown pending frequency coordination outcome)

Phase 2 Team Members

⌘ Rockwell Collins

☒ Data Storage, Displays, Receivers, Antennas, Integration, STC, Data Reduction and Analysis

⌘ WorldSpace Corporation

⌘ Satellite channel, Receiver card, Ground Station Feed

⌘ Jeppesen

☒ Weather Products & Laptop Software

⌘ American Airlines

☒ STC Installation Support, Flight Test and Evaluation

Phase 2 Status

⌘ Systems installed on two American Airlines B777-200. STC approved by FAA. Aircraft now in revenue service.

☒ System includes:

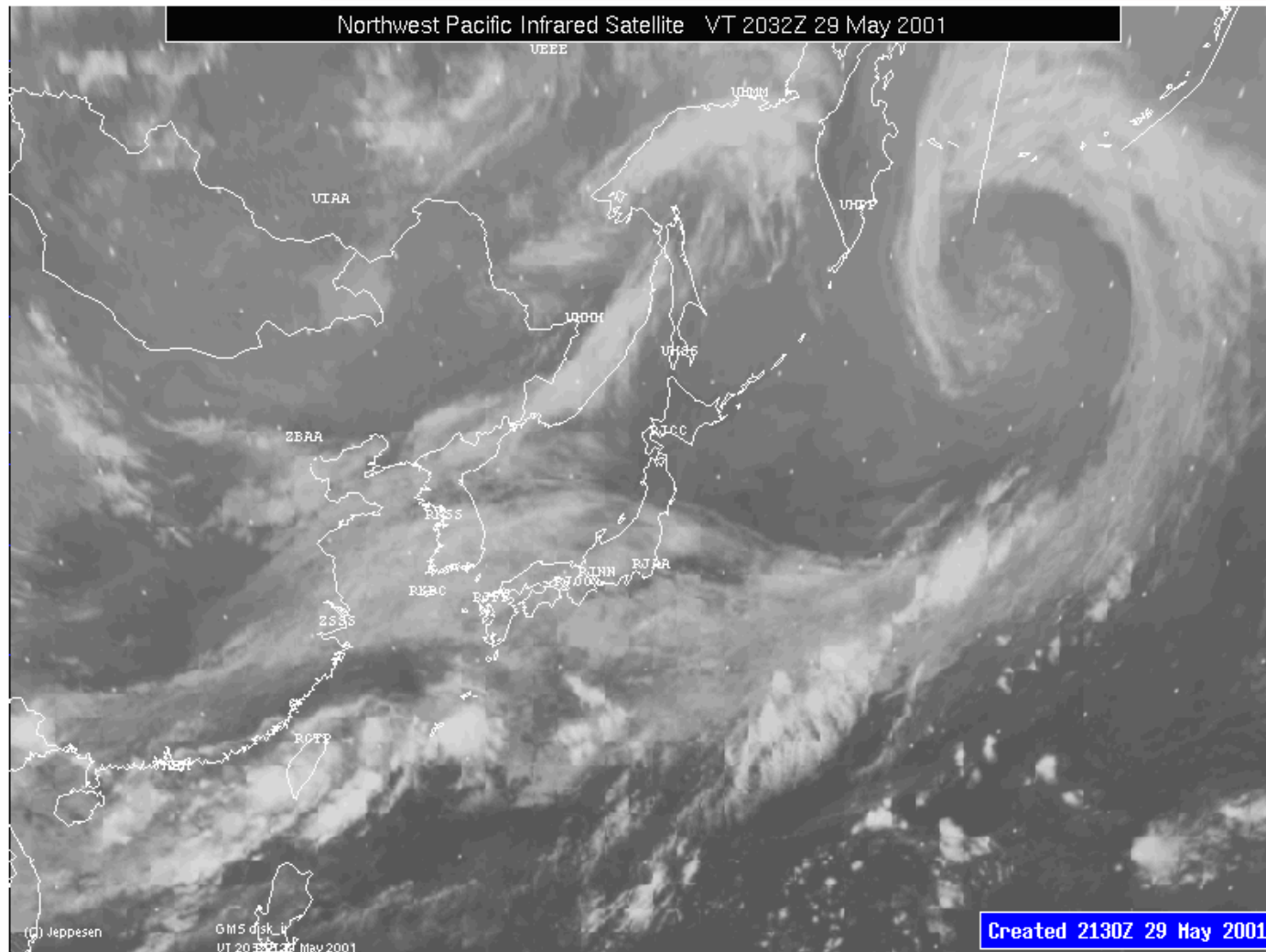
- ☒ **Patch antenna,**
- ☒ **Satellite receiver,**
- ☒ **File Server Unit (FSU),**
- ☒ **Avionics Secure Interface Unit,**
- ☒ **Wireless LAN network and**
- ☒ **Pilot laptop computer(s)**
- ☒ **Approved Software**

☒ Test Coverage uses Asiastar NE Beam.

Weather Graphics

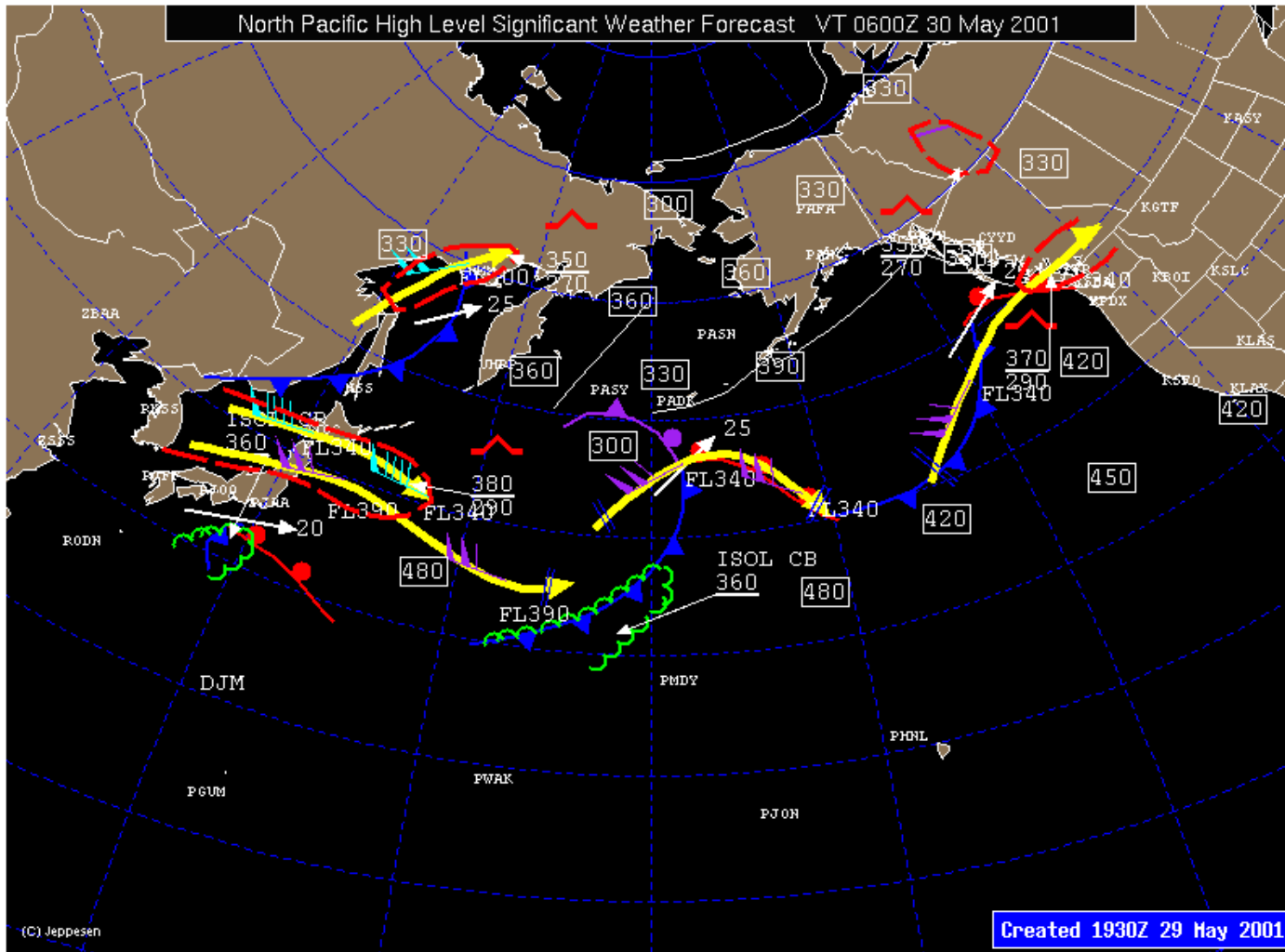
- Winds and Temperatures aloft
 - Flight Levels 050 through 450
- Surface Weather (Ceiling, Winds and Visibility)
- Hi-level Significant Weather
- Visible and Infra Red satellite imagery
- Surface analysis
- Update rate varies from once per hour to once per 6 hours
 - Specific to type of graphic
- All weather graphics have track file and aircraft position overlays, zoom capability.
- Detailed geographic features and airport diagrams can be inserted by pilots as needed.
- File server provides “time lapse” weather movement graphics as called for by pilots

Satellite Infrared Imagery

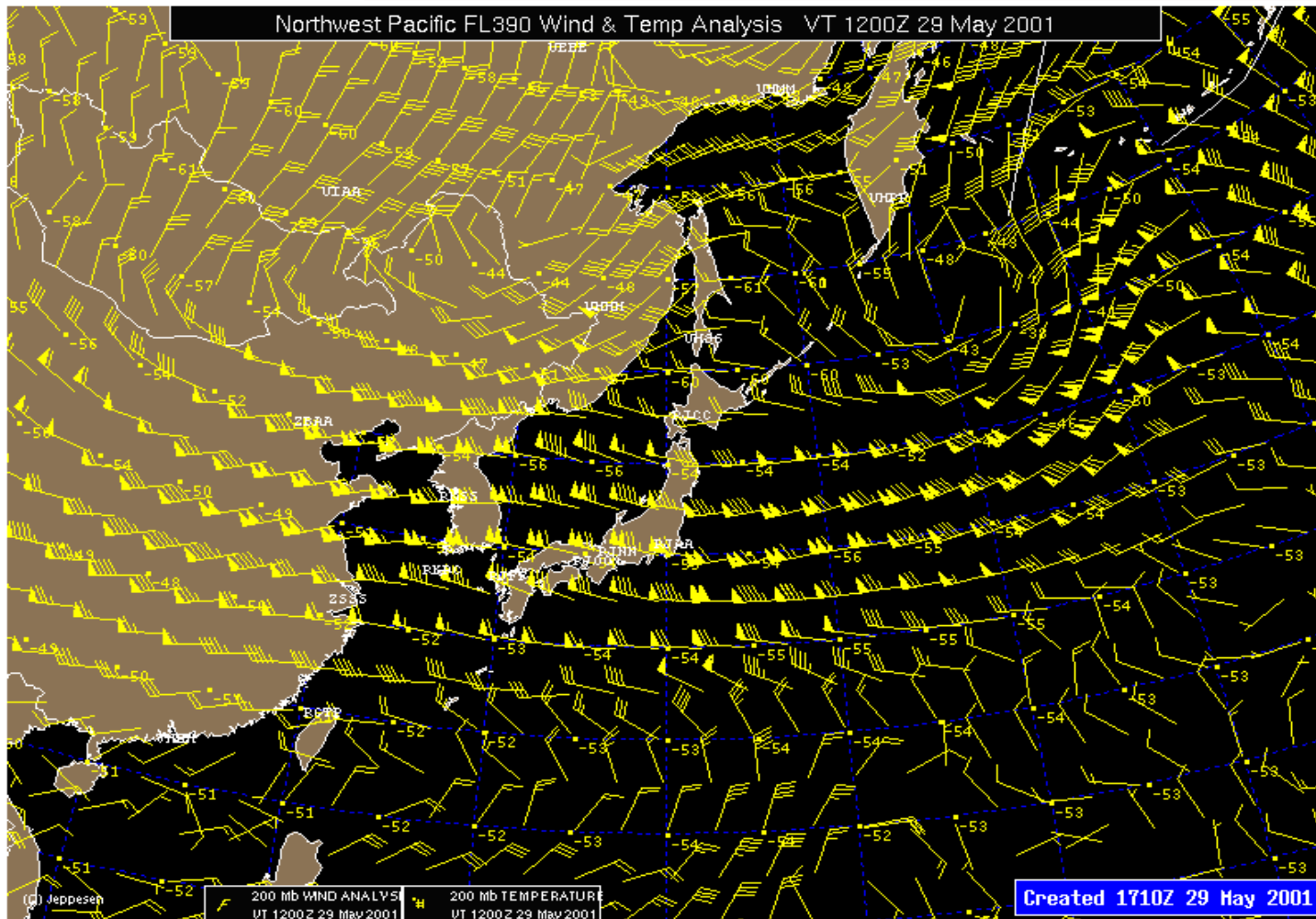


**Rockwell
Collins**

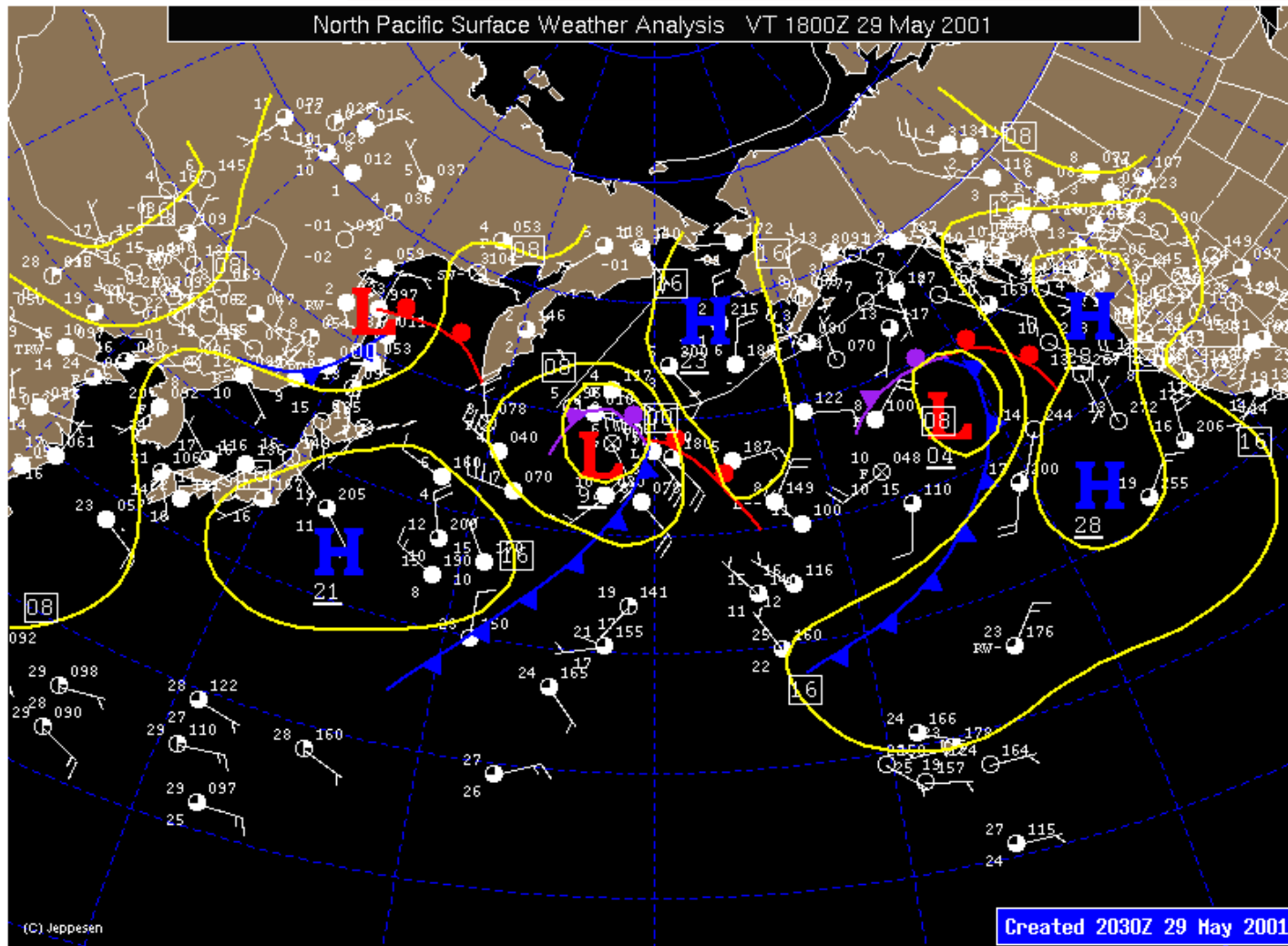
N. Pacific High level Significant WX



Winds & Temps Aloft at 39,000 ft



Surface Analysis



Air Coverage and Pilot Updates

- Two B777-200 aircraft operate as needed for all long haul routes for American Airlines.
 - These aircraft are not restricted only to Trans-Pacific routes.
- City pairs presently covered include:
 - Chicago, Dallas, San Jose CA to/from:
 - Narita, Osaka and Taipei.
- System provides coverage using NE Asiastar Beam (see map)
 - Coverage enroute up to 5 hours.
- Pilots get same material on the ground via AA's company Intranet at both ends of the routes.
- Analysis data obtained from Questionnaires and FDRs.

Data Routing

- Jeppesen generates weather graphics at scheduled intervals at Los Gatos, CA.
- Graphics are encoded and sent to WorldSpace GES in Melbourne, Australia and American Airlines in Dallas via Internet FTP.
- Melbourne GES uplinks each file to satellite 3 times at short intervals.
- Satellite transmits data at 64 Kbits/second.
- Satellite receiver recovers files, checks data validity and transfers valid data to File Server Unit (FSU) for storage.
- FSU manages data files and makes files available to pilot via WLAN on aircraft. FSU maintains aircraft position and time. Provides information to laptop to allow aircraft to be plotted on graphics.
- Time delay from Jeppesen to Aircraft is less than 60 seconds.
 - Satellite typical transmission time - 2.5 to 8 seconds

Weather Benefits

- ⌘ **American Airlines has keen interest in adverse weather.**
 - ☒ **Early flight change decisions based on weather data leading to:**
 - **Higher on-time arrival rates**
 - **Improved fuel savings**
 - **More comfortable ride to passengers (avoid turbulence)**
 - ☒ **Better weather data for remote routes such as South America and Pacific rim.**
- ⌘ **Enhanced flight safety**
 - ☒ **Reduce number of injuries due to unexpected turbulence.**